APPARATUS FOR RECEIVING A FORCE INPUT

This application is a utility application which claims the benefit of priority of U.S. Provisional Patent Application No. 60/267,340, filed on February 8, 2001, entitled "Centripetal Linear And Rotary Propulsion Device".

BACKGROUND OF THE INVENTION

I. Field of the Invention.

The present invention relates generally to force receiving apparatuses and more particularly to an apparatus for receiving rotational energy by rotating an assembly about its longitudinal axis which then turn crank throws, upon which eccentrics are mounted, to revolve around the longitudinal axis.

II. Description of the Related Art.

Various devices are well known in the prior art which transmit energy and converts that energy from linear to rotational and vice versa. Many such devices use eccentrics to modify the resultant force output.

For instance, the patent to Mount (No. 4,072,066) discloses a transmission which uses eccentrics to control power output by having the eccentrics mounted transversely to the drive axis to modify the drive ratio of a planetary gear transmission by centrifugal force associated with a rotor assembly having an imbalance that varies as a function of the speed of oppositely rotating eccentric rotor elements relative to a carrier frame mounting planetary gears drivingly connected to a spider on which the rotor assembly is mounted.

In the Peterson Patent (No. 4,744,259) there is disclosed a device for generating a unidirectional force comprising a rotary body carrying around its periphery a plurality of pivotal pendulum masses mounted on shafts parallel to the axis of rotation of the rotary body so that the pendulum masses swing transversely to the main access of rotation. As the device rotates, each pendulum mass flings outwardly to produce a unidirectional force symmetrical about a central axis.

The Moller Patent (No. 4,307,629) discloses a torque converter having an input shaft, an output shaft and preferably three or more torque generating trains each having a rotatable shaft whose axes are fixed relative to the axis of an input shaft. Each of the torque generating trains has a pair of double-weight torque generators thereon wherein the weights are eccentrically mounted upon the shaft of their respective torque generating trains. However, in each torque generator a pair of substantially identical weights are mounted for freedom of rotation relative to a pair of cylindrical bearing surfaces which are eccentrically positioned relative to the axis of their torque generating train shafts and which have their eccentricities 180° apart on the shafts. As the cage of the device is spun about the axis of its torque generating train, the eccentrically mounted weights are also spun with the cage and the weights apply torque to the shafts of their torque generating trains.

SUMMARY

In accordance with the present invention and the contemplated problems which have and continue to exist in this field, the present invention receives a rotational force input that may be directed angularly transversely from the central axis of rotation of the device as desired.

The invention accomplishes the above and other objects of the invention by utilizing rotating masses to receive a force. The operation of the apparatus is based on the lengthening and reduction of the radii of moving eccentric masses in relation to a common point, this point being the major axis assembly carrier shaft.

When the apparatus is viewed in end elevation as in Figures 1-4, the centerline of the carrier shaft provides a mean line of transition with the upper quadrants above the carrier shaft being in positive position and the lower quadrants being in negative position. This relates to the force asserted upon the eccentrics being in the upper mode to thereby apply this received force to the unit assembly. In Figures 1-4, the radii of the moving eccentric mass, with respect to the carrier shaft, can be measured from the mean radius of the eccentrics both in the positive and negative positions. The view of Figure 1 discloses one internal force receiving unit at the top dead center position after it has completed a 180° revolution, while Figure 2 discloses the force receiving unit rotating clockwise with the planet gears walking around the sun gear while the radius of the positive upward most eccentric is being reduced and the radius of the lower most negative eccentric is being lengthened.

In Figure 3, the crank throw wrist pins are positioned downward. The right most eccentric is being pulled inward as the left eccentric is being pulled outwardly, and such movement of the eccentrics generally cancel the resultant force of each. Even though the wrist pins are below the mean line of transmission, the force generated by the eccentric on

the right is reversed as it is being rotated counterclockwise, while the left most eccentric is being pulled clockwise, which is the same direction as the assembly is rotating. The positive gear action against a negative moves the radii points upward to the transitional line, which is the centerline of the crank throws thereby employing the force pitted against the planet gears themselves. In relation to a 90° rotation as shown in Figure 3 with the eccentrics horizontal and opposite from each other, the radius of the right most eccentric , when viewed in the drawings, is being forced to shorten thereby exerting an outward force and the radius of the left most eccentric is being lengthened and thus produces less force. To compensate the force difference, a timing mechanism may be installed to direct the resultant forces as desired.

The radii of the eccentrics, with respect to the carrier shaft, are lengthened and shortened with the use of crank throws to which the eccentrics are mounted. The planetary gears are attached to one side of the crank throws. As the planetary gears rotate around the sun gear, which is fixedly mounted to the carrier shaft, the crank throws are rotated along with the planetary gears. When the crank throws rotate, the wrist pins are moved with respect to the centerline of the carrier shaft. The eccentrics are attached with the wrist pins. While the eccentrics are freely moveable on the wrist pins, they do not rotate. The wrist pins, however, do rotate with respect to the eccentrics. This action leaves the eccentrics to

seek their own path away from the wrist pins. Therefore, positive and negative eccentrics are in line with each other in regard to the position of the wrist pins. If the eccentrics are held rigid, this position offsets the alignment of the positive and negative eccentrics.

Other objects, advantages and capabilities of the invention are apparent from the following description taken in conjunction with the accompanying drawings showing the preferred embodiment of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a partial elevation section view of the internal force receiving units 100A and 100B of Figure 5, showing the units in the top dead center position;

Figure 2 is a partial elevation section view of the internal force receiving units 200A and 200B of Figure 5, showing the units rotated 45°;

Figure 3 is a partial elevation section view of the internal force receiving units 300A and 300B of Figure 5, showing the units rotated 90°;

Figure 4 is a partial elevation section view of the internal force receiving units 400A and 400B of Figure 5, showing the units rotated 135°;

Figure 5 is a side elevation view, partially in section, showing an assemblage of eight internal force receiving units completing one complete force cycle;

Figure 6 is an exploded perspective view of one individual force receiving unit;

Figure 7 is an exploded perspective view of the end mounting plates of the apparatus, along with the timing mechanism; and

Figure 8 shows a graphical representation of one internal force receiving unit of the apparatus through 180° of rotation.

DETAILED DESCRIPTION

Referring to the drawings wherein like reference numerals designate corresponding parts throughout the several figures, reference is made first to Figure 5 showing a completed eight unit force receiving apparatus 11. The force receiving apparatus 11 generally comprises a carrier cage 16 having a proximal mounting plate 12 on one end thereof and a

distal mounting plate 13 on the other end thereof, interconnected by a plurality of cage shafts 14. In the apparatus 11 of Figure 5, the apparatus is shown with eight internal force receiving units identified as 100A, 100B and 200A, 200B and 300A, 300B and 400A, 400B. In general, the embodiment of the apparatus 11 illustrated may include more or less internal force receiving units than is shown in Figure 5, depending upon the use for which the force receiving apparatus is to be put. Each of the internal force receiving units are mounted about the carrier shaft 15, which carrier shaft is maintained fixed in a non-rotating condition and the carrier cage 16 rotates there around carrying all of the internal force receiving units therewith.

Each of the internal force receiving units are divided by internal end plates 17 to which various parts of the internal force receiving units are attached, except that the end-most units have the outside mounting plates 12, 13 for mounting surfaces. Referring now to Figure 7, the mounting plates 12, 13 are rotatable around the carrier shaft 15 upon carrier bearing hub assemblies 18, which ride in main bearing assemblies 19, which are in turn positioned with the main bearing carrier assemblies 21.

In order for the apparatus 11 to vary the internal force relationship a timer mechanism 22 for controlling this internal force relationship produced by the apparatus 11 upon an input force is shown in Figure 7. The timing mechanism 22 of the present embodiment is capable of determining the resultant net internal force component of the

apparatus 11, and the resultant internal direction to which the force is directed. The timing mechanism 22 is fixed to the carrier shaft 15 and if the timing sequence handle 23 is rotated wither clockwise or counterclockwise, as seen in Figure 7, such movement repositions carrier shaft 15 with respect to the carrier cage 16. As indicated in Figure 7, the timing sequence handle 23 is affixed to the end of the carrier shaft 15 and mounted adjacent to the timing plate 24, which plate has a plurality of apertures 39 angularly positioned there around to receive the detent point 25 of the locking pin 26. The timing plate 24 remains fixed to the main bearing carrier assembly 26 and does not rotate. Therefore, any movement of the timing sequence handle 23 rotates the carrier shaft 15 and changes the orientation of the internal force receiving units with respect to a fixed direction.

Referring now to Figure 6 that shows an exploded view of one internal force receiving unit, it is seen that each force receiving unit revolves around carrier shaft 15 as the internal end plates 17 are rotatably mounted thereupon by bearings 27. In Figure 6, the internal force receiving unit being described in unit 100A. Other units are identical to 100A and the following description is applicable to all units. Unit 100A includes one internal end plate 17 while the other end plate is the proximal mounting plate 12 that has a carrier bearing 27 fixed in the carrier bearing hub assembly 18, which in turn is positioned on the mounting plate 12 to thereby allow mounting plate 12 to rotate around the carrier shaft 15. The mechanism between plated 12 and 17 therefore comprises one complete internal force receiving unit. The force receiving unit comprises a sun gear 28 mounted to the carrier

shaft 15 around which two planet gears 29 engage the sun gear 28 and revolved there around. The planet gears 29 are mounted upon needle bearings 31 which are, in turn, mounted within the end plate 17. Each planet gear 29 is mounted to crank throw units 32a, 32b that also rotate around needle bearings 31. Positioned within one aperture of each crank throw is a wrist pin 33 that is affixed within the crank throw unit so that it does not rotate. Positioned upon each wrist pin is an eccentric and in the case of force receiving unit 100, they are identified eccentrics A-1 and B-1. Each eccentric includes an aperture therein \that is mounted off center, and within the aperture is an internal needle bearing 34 into which the respective wrist pin fits to allow free rotation of the eccentric.

The respective wrist pins 33 project from crank throw units 32 through eccentrics A-1 and B-1, and into crank throw units 32c, 32d. Crank throws 32c, 32d are mounted to proximal mounting plate 12 by shoulder bolts 35c, 35d that project through suitable crank throw and needle bearings 36 through crank throws 32c, 32d and are ultimately positioned with proximal mounting plate 12.

During operation, a rotational force is applied to the gear teeth 37 of the distal mounting plate 13, which spins the entire carrier cage 16 around carrier shaft 15 carrying with it all of the internal force receiving units contained therein, such that the apparatus 11 as a whole receives the overall input force, and each internal force receiving unit receives a proportionate component of the input force. The discussion of the operation of the individual

force receiving units applies equally to all, except in the embodiment presented herein the various sets of the four units have each one offset with relation to the other in the angular direction of 45°. The embodiment shown in Figure 5 shows two sets of the four units wherein pairs of the units are in the same angular disposition. The embodiment is not deemed as limiting as this embodiment or other embodiments receive input utilizing only one force receiving unit, but the force receiving apparatus 11 receives force more effectively if there are at least four internal force receiving units used in unison.

To further discuss operation, reference is now made to Figures 1-4 and 8. Figure 1 shows a unit either completing a revolution or beginning a revolution, inasmuch as the unit is at top dead center at a rotation of 0°. In Figure 2, as the carrier cage is spun, the unit rotates clockwise as looking at the drawing that shows eccentric A-1 having the radius of its center of mass slightly shortening with respect to the centerline of carrier shaft 15. The radius of the center of mass of eccentric B-1 is lengthening a slight amount at the rotation of 45°. At the position shown in Figure 3, this being a rotation of 90°, the radii if the center of masses if eccentrics A-1 and B-1 are equal to one another and the forces represented by the movement of the eccentrics cancel one another , inasmuch as the force of eccentric A-1 is moving in a counterclockwise direction whereas the resulting force of eccentric B-1 is moving in a clockwise direction and the radii are equal. Figure 4 indicates a rotation to 135° showing the radius of the center of mass of eccentric A-1 from the centerline of carrier shaft 15 shortening while the radius of the center of mass of eccentric B-1 from the centerline

of carrier shaft 15 is lengthening thereby developing a force mismatch, or power stroke. The end of the power stroke is depicted in Figure 1, which represents a full 180° rotation of the unit showing that eccentric B-1 is now at the top dead center and eccentric A-1 is at the bottom dead center. The radius of the center of mass of eccentric A-1 with respect to carrier shaft 15 is short, while the radius of the center of mass of eccentric B-1 with respect to carrier shaft 15 is long, thereby indicating a maximum force mismatch and full power stroke. The orbit path for a 180° revolution is fully shown in Figure 8 and discloses the full power stroke and internal force mismatch with respect to the eccentrics A-1, B-1, lying well above the mean line of transition 38 indicating the state after the input force has been applied.

With respect to the timing mechanism 22, the previous discussion has been made with the assumption that the timing control handle 23 is pointed vertically and has not been rotated to effect any particular timing other than to time the unit in a vertical direction. However, if handle 23 is rotated, and since it is fixed to the carrier shaft 15 on which the sun gear 28 is fixed, then the rotation of the handle 23 also rotated sun gear 28. For instance, if handle 23 initially starts in the most vertical locking aperture 39a, then the state of the force receiving apparatus 11 would be oriented vertical as described. However, should the handle 23 be rotated so that the detent point 25 be placed in locking aperture 39b, the sun gear 28 also rotates the same angular amount thereby positioning the individual force receiving units a like amount of angular direction. In this manner, the timing mechanism changes the direction of input force and thus the reactive state of the apparatus 11 to a

position that corresponds with the timing mechanism 22 and, in this case, essentially in the direction which the position of the timing sequence handle points. Therefore, the timing mechanism can be used to change the state of the apparatus as an input force is applied, generally transverse the longitudinal axis of the carrier shaft 15.

Therefore, the foregoing is considered as illustrative only of the principles of the invention. Further, various modifications may be made of the invention without departing from the scope thereof and it is desired, therefore, that only such limitations shall be placed thereon as are imposed by the prior art and which are set forth in the appended claims.